INSIGHTS INTO ADSORPTION PROCESSES AT CARBON-BASED ELECTRODES AND STATIONARY PHASES

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Carbon-based materials are used extensively as substrates in electroanalytical chemistry and as stationary phases in liquid chromatography [1, 2]. In spite of widespread use, fundamental details related to adsorption of on these materials remains poorly understood. Electrochemical descriptions of adsorption focus primarily on the role of edge plane sites (i.e., multiple adsorption sites) [1], whereas chromatographic descriptions view interactions with the basal plane (i.e., a single adsorption site) to be the basis of adsorption [2].

This presentation examines issues related to adsorption on carbon materials within the context of retention data obtained using electrochemically-modulated liquid chromatography (EMLC). EMLC is a separation strategy that couples electrochemistry and liquid chromatography, exploiting the ability to manipulate analyte retention through changes in the potential applied to conductive stationary phases like glassy carbon and porous graphitic carbon [3]. To examine the merits of the two descriptions of adsorption, we examined the retention dependence of a series of model compounds (i.e., monosubstituted benzene sulfonates) as a function of the concentration and identity of the supporting electrolyte and the applied potential. The importance of surface oxides on adsorption was also investigated by varying the oxygen content by oxidizing and reducing plasma treatments. The results of these experiments will be examined within the context of prevailing interpretations as well as within the context of classical electrical double layer theory.

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